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(54) Title: STABLE COFFEE CONCENTRATE SYSTEM

(57) Abstract

A beverage system for providing a coffee beverage. The beverage system contains a coffee base concentrate and coffee aroma. The coffee base concentrate has a soluble coffee solids concentration of at least 10 % by weight and is free of coffee aroma. The coffee base concentrate and the coffee aroma are stored separately and are combined upon reconstitution for providing a coffee beverage. Separate store of the coffee base concentrate and the coffee aroma increases the stability of the system.

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STABLE COFFEE CONCENTRATE SYSTEM

Field of the Invention

This invention provides a beverage system containing a stable coffee concentrate and coffee aroma. The stable coffee concentrate and coffee aroma may be reconstituted to provide an aromatized coffee beverage. The invention also relates to a method for providing the beverage system.

Background to the Invention

Coffee products which are in a form convenient for the consumer, are commonly available as soluble beverage powders and ready-to-drink liquid beverages.

Coffee products in the form of soluble beverage powders may be of extremely high quality; to the point were they provide a beverage very similar to freshly brewed beverages. Despite this, they are still perceived as being inferior to freshly brewed coffee. Also, the fact that soluble beverage powders are in powder form creates problems in many food service applications where the product is dispensed from a machine. In particular, problems such as mechanical degradation of the powder, bridging, and blocking occur.

Ready-to-drink liquid coffee beverages are very popular in Asian markets. The beverages are made up of soluble coffee solids, stabilizers, water and, usually, sugar. For whitened beverages, a creamer or whitener may be included. Ordinarily, these beverages have a soluble coffee solids concentration of about 1% by weight. These beverages are very often consumed cold and, in general, have organoleptic properties which are different than freshly brewed coffee. Therefore they do not, and in fact are not intended to, provide a substitute to freshly brewed coffee.

There have also been attempts to provide convenient coffee products in concentrate form. In theory, a coffee concentrate offers the advantages of being perceived to have better quality than soluble beverage powders, and being simple to apply in food service applications. Unfortunately, coffee concentrates are unstable and this has severely limited their application. One problem appears to be the increase of acidity over time which negatively influences the quality of the beverage reconstituted from the coffee concentrate. Also, curdling of whitener or creamer components may occur.

Attempts have been made to avoid or reduce the acidity increase by adding base to the concentrate. For example, European patent application 0861595 describes treating a coffee concentrate with alkali to convert acid precursors to their acid salts, and then neutralizing the treated concentrate with acid to bring the pH to about 4.7 to 5.3. This process is described to convert the acid precursors to stable salts and hence prevent the formation of acid during storage.

Another possible method of avoiding or reducing the acidity increase in aromatized coffee concentrates is to increase concentration to above about 55%. This is described in European patent application 0893065.

These processes provide some improvement of the storage stability of the coffee concentrates. However, quality deterioration still occurs. Therefore there is still a need for a stable coffee concentrate.

Summary of the Invention

Accordingly, this invention provides a beverage system for providing a coffee beverage, the beverage system comprising:

a coffee base concentrate having a soluble coffee solids concentration of at least about 10% by weight and from which coffee aroma has been removed; and

coffee aroma separate from the coffee base concentrate;

the coffee base concentrate and coffee aroma being combinable upon reconstitution for providing a coffee beverage.

It has been surprisingly found that separation of the coffee base concentrate and coffee aroma significantly improves stability. The coffee base concentrate and coffee aroma may be each stored in a separate container or may be stored in separate compartments of a single container. The containers are preferably dispenser containers.

In another aspect, this invention provides a beverage system for providing a coffee beverage, the beverage system comprising a container including:

a first storage compartment containing a coffee base concentrate having a soluble coffee solids concentration of at least 10% by weight and from which coffee aroma has been removed, and

a second storage compartment containing coffee aroma.

Preferably, the soluble coffee solids concentration of the coffee base concentrate is at least about 50% by weight; for example about 50% to about 65% by weight.

In another aspect, this invention provides a method for improving the storage stability of a coffee concentrate, the method comprising separately storing a coffee base concentrate having a soluble coffee solids concentration of at least 10% by weight and from which coffee aroma has been removed; and coffee aroma.

Detailed Description of the Invention

Embodiments of the invention are now described by way of example only. This invention is based upon the finding that the separate storage of concentrated soluble coffee solids and coffee aroma significantly improves the stability of the concentrated soluble coffee solids. Therefore, by separately storing the coffee base concentrate and coffee aroma and recombining them upon reconstitution, a coffee beverage of good quality may be provided.

The coffee base concentrate may be obtained using any suitable procedure since the exact procedure used is not critical. Usually, the coffee base concentrate is prepared by concentrating a coffee extract obtained from a coffee extraction process to the desired coffee concentration. The coffee extract may be produced in the usual manner by subjecting roasted coffee beans to extraction. Any suitable extraction procedure may be used because the choice and design of the extraction procedure is a matter of preference and has no critical impact on the invention. Suitable extraction procedures are described in European patent applications 0826308 and 0916267; the disclosures of which are incorporated by reference. Similarly, any suitable concentration procedure may be used because the choice and design of the concentration procedure is a matter of preference and has no critical impact on the invention. Of course, the coffee base concentrate may also be prepared by dissolving soluble coffee powder in water to the desired concentration.

The concentration of the coffee base concentrate is at least about 10% by weight, preferably the concentration being high enough such that the concentrate will not support the growth of microorganism for example about 50% to about 65% by weight. The concentration may be more than 65% by weight but then dispensing becomes more difficult due to increasing viscosity.

The coffee base concentrate may be treated to account for or reduce the formation of acids during storage. To account for the formation of acids during storage, the pH of the coffee base concentrate may be raised about 0.5 to 1.0 unit

higher than original pH. The pH will still fall during storage but the coffee base concentrate will not become too acidic during acceptable shelf life times. The pH may be raised using any suitable procedure. For example, an alkali may be added to the coffee base concentrate to raise the pH. Suitable alkalis include sodium hydroxide, calcium hydroxide, potassium hydroxide and sodium bicarbonate. Alternatively, the pH may be raised using ion exchange process with an ion exchange resins. This offers the advantage that the no additives are added to the coffee base concentrate. It is preferred that the coffee base concentrate is obtained from extract subjected to ion exchange treatment to raise pH. If further desired, coffee base concentrate can be stored under frozen condition. This has the advantage that the stability of coffee base concentrate may be improved.

The formation of acids may be reduced or prevented by inducing hydrolysis of the acid precursors in the coffee base concentrate. This may be done by raising the pH to cause the acid precursors to form stable salts and then reducing the pH of the concentrate. This may be done by adding alkali as described in European patent application 0861596 or by using ion exchange. Usually the pH will be raised to above about 9. The pH may again be lowered to a normal coffee pH range using suitable acids or ion exchange. Alternatively, the acid precursors may be thermally hydrolysis or enzymatically hydrolyzed; for example by using an esterase.

The formation of acids may also be reduced or prevented by removing acid precursors from the coffee base concentrate using membrane fractionation process. It is preferred that the coffee base concentrate is obtained from extract subjected to membrane fractionation. Suitable membranes are commercially available.

It is also possible to add an alkali to the base coffee concentrate at the time of reconstitution of the beverage. This may be done by dispensing an alkali along with the base coffee concentrate.

The coffee base concentrate should be substantially free of coffee aroma. Merely processing the roasted coffee beans to a coffee base concentrate as described above will result in the loss of substantially all coffee aroma. However, it is preferred to specifically strip off and then collect the coffee aroma during processing. In this way, the coffee aroma is not lost. Processes for stripping off and collecting the coffee aroma are well known. Usually coffee aroma is stripped off at one or more stages; for example:-

- using an inert gas during, or immediately after, grinding of the coffee beans, and

- using steam to strip coffee aroma from the coffee extract during extraction.

Alternatively, the fresh coffee grounds may be slurried in water or coffee extract and the coffee aroma stripped from the slurry. A suitable procedure is described in International patent application PCT/EP99/00747; the disclosure of which is incorporated by reference.

The coffee aroma may be captured using any suitable procedure. Ordinarily, the coffee aroma is captured by condensing from the carrier gas it in one or more condensors. Preferably more than one condenser is used; each succeeding condenser being operated at a lower temperature than the previous condenser. If necessary or desired, one of the condensers may be a cryogenic aroma condenser. A suitable cryogenic aroma condenser is described in US patent 5,182,926; the disclosure of which is incorporated by reference. The captured coffee aroma may, if desired, be concentrated using a suitable technique such as partial condensation or rectification.

The captured coffee aroma may be combined with a suitable carrier substrate such as coffee oil or an emulsion containing coffee oil.

The processes for the production of the coffee extract and capture of the coffee aroma may be carried out under oxygen reduced or oxygen free conditions if desired. This may be accomplished as is known in the art; for example by carrying out the processes under a blanket of inert gas. Further, deoxygenated water may be used whenever water is necessary in the process.

The coffee aroma is preferably stored under oxygen reduced or oxygen free conditions. Similarly, the coffee base concentrate may stored under oxygen reduced or oxygen free conditions. Further, if desired, oxygen scavengers may be added to the coffee aroma and/or coffee base concentrate. Suitable oxygen scavengers are described in European patent application 99200185.9; the disclosure of which is incorporated by reference. If further desired, coffee aroma can be stored under frozen condition. This has the advantage that the stability of the aroma may be improved.

For food service applications, the coffee base concentrate and the coffee aroma may be separately stored in suitable dispenser containers. The containers may be separate for the coffee base concentrate and the coffee aroma or a single container having separate storage chambers may be used. The containers are

suitably pouches made from barrier films which are able to keep water vapor, oxygen and light transmission to a minimum. Suitable barrier films are commercially available; for example polyester/aluminum/polyethylene barrier films.

For retail applications, the coffee base concentrate and the coffee aroma are preferably packaged in suitable containers which have separate storage chambers for the coffee base concentrate and the coffee aroma. Suitable containers include multi-compartment stick packs; sachets; carton-based, tetrahedron packs; Unifill packs; squeezeable plastic bottles; stand up pouches; plastic cups; etc. The containers are preferably designed such that opening of the container opens both chambers such that both the coffee base concentrate and the coffee aroma are simultaneously available for reconstitution of the beverage.

Example 1

Roast and ground coffee is fed into a slurry tank along with a coffee extract containing about 8 to 10% by weight of soluble coffee solids. The resulting slurry is fed to the top of a disc and donut stripping column using a slurry pump. Steam at a low pressure of less than about 20 kPa (gauge) is fed into the bottom of the stripping column. The stripping rate is 50% by weight of steam compared to roast and ground coffee.

The aromatized gas stream leaving the stripping column is subjected to concentration by rectification in a packed rectification column. The liquid condensing in the rectification condenser is collected and comprises about 10% by weight of the roast and ground coffee. The coffee aroma is placed in glass vials and protected from oxygen.

The stripped slurry leaving the stripping column is then subjected to extraction in a continuous extraction system made up of three extraction reactors and two solubilization reactors. The system is as described in European patent application 0826308. The extraction reactors are operated at 120°C, 110°C and 110°C respectively. The solubilization reactors are operated at 1.75 MPa for 5 minutes and 1.75 MPa for 8 minutes respectively. The water used in the extraction system is deoxygenated and an inert blank is used with the system to reduce oxygen ingress.

The extract obtained is called stripped extracted and is further concentrated using a evaporation system to provide a coffee base concentrate containing about

55% by weight of soluble coffee solids. About 0.75% to 1% of NaOH (by weight relative to coffee solids) is added to the coffee base concentrate. This amount of NaOH is sufficient to neutralize acid formation over a period of 6 months. The coffee base concentrate is then filled in glass vials and held under inert gas conditions.

Three sample groups are prepared for storage. For the control group, coffee base concentrate is combined with coffee aroma at a level of about 10% coffee aroma and frozen at -40°C. The coffee base concentrate and coffee aroma are protected from oxygen during the process. For group A, coffee base concentrate is combined with coffee aroma at a level of about 10% coffee aroma and filled into glass vials. The coffee base concentrate and coffee aroma are protected from oxygen during the process. For group 1, the coffee base concentrate and coffee aroma are separately stored in the glass vials. The vials of groups A and 1 are stored at 20°C under an inert gas for up to 6 months.

A coffee beverage is prepared from each sample group over the period of the storage trial and evaluated by a panel using the "Difference from Control" sensory evaluation method. When preparing beverages from sample group 1, about 10% by weight coffee aroma is added to the base coffee concentrate. Each of the storage samples is evaluated against to the frozen control. Each panelist gives a score between 1 and 10 to indicated the degree of difference. If the score is 9 and 10, this means that the panelist could not tell the storage sample as being different from frozen control. If the score is between 6 to 8, a difference from frozen control is detected but the difference is acceptable. If the score is below 6, the difference between the storage sample and the frozen control is not acceptable. If a score below 9 is given, each panelist is asked to describe the differences under the following attributes: cloudiness, coffeeness, roastyness, pruneyness/molasses, acidity, bitterness and body. Panelists are also free to use other attributes to describe the differences. At the end of evaluation, the panel give a consensus score for the samples being evaluated.

The beverages prepared from the samples of group 1 score a value of 6 to 8 during the trial. After six month storage, the differences are (1) less coffeeness, (2) less roastyness and (3) some development of green, woody characteristics. However, the differences are acceptable. The beverages prepared from the samples of group A score a value of less than 6 and are not acceptable.

Example 2

The process of example 1 is repeated except that, instead of adding NaOH to the coffee base concentrate, the stripped extract is subjected to membrane fractionation process, specifically ultra-filtration, using a membrane with a 3.5K molecular cut off to have about 25% of coffee solids removed in the permeate. It is preferred to use the stripped extract to prevent loss of aroma during processing. And then the retentate is further evaporated to form coffee base concentrate. The coffee base concentrate and coffee aroma are separately stored in the glass vials. The beverages prepared from the coffee base concentrate and coffee aroma score a value of 6 to 8 during the trial.

Example 3

The process of example 1 is repeated except that, instead of adding NaOH to the coffee base concentrate, the stripped extract is passed through an ion exchange column containing Dowex 22 resins to raise the pH equivalent of addition of 1% NaOH (by weight relative to coffee solid). It is preferred to use stripped extract to minimize the damage of coffee aroma during processing. The treated stripped extract is further evaporated to form coffee base concentrate The coffee base concentrate and coffee aroma are separately stored in the glass vials. The beverages prepared from the coffee base concentrate and coffee aroma score a value of 6 to 8 during the trial.

Example 4

The process of example 1 is repeated except that coffee aroma is stored under frozen condition

The beverages are prepared from the coffee base concentrate and the frozen stored coffee aroma score a value of 6 to 8 during the trial.

Example 5

The coffee base concentrate and the coffee aroma of group 1 are inoculated with a microbial cocktail containing 32 yeast, 22 mold and 15 lactic acid bacteria

strains. The samples are stored at 20°C. No growth is detected and all organisms die after two weeks or longer.

We claim

1. A beverage system for providing a coffee beverage, the beverage system comprising:

a coffee base concentrate having a soluble coffee solids concentration of at least 10% by weight and from which coffee aroma has been removed; and

coffee aroma separate from the coffee base concentrate;

the coffee base concentrate and coffee aroma being combinable upon reconstitution for providing a coffee beverage.

2. A beverage system according to claim 1 in which the coffee base concentrate has a soluble coffee solids concentration of about 50% to about 65% by weight.

3. A beverage system according to claims 1 or 2 in which the coffee base concentrate includes an alkali.

4. A beverage system according to any of claims 1 to 3, in which the coffee base concentrate subjected to ion exchange treatment to raise pH.

5. A beverage system according to any of claims 1 to 4, in which the coffee base concentrate subjected to membrane fractionation for removal of acid precursors.

6. A beverage system according to any of claims 1 to 5, in which the coffee aroma includes an oxygen scavenger.

7. A beverage system according to any of claims 1 to 6, in which the coffee aroma is stored under frozen condition.

8. A beverage system according to any of claims 1 to 7, in which the coffee base concentrate is stored under frozen condition.

9. A beverage system according to any of claims 1 to 8, in which the coffee base concentrate includes an oxygen scavenger.

10. A beverage system according to any of claims 1 to 9, in which the coffee base concentrate and coffee aroma are each stored in a separate dispenser container.

11. A beverage system according to claim 10 in which each container is a pouch comprising barrier films.

12. A beverage system for providing a coffee beverage, the beverage system comprising a container including:

a first storage compartment containing a coffee base concentrate having a soluble coffee solids concentration of at least 10% by weight and from which coffee aroma has been removed, and

a second storage compartment containing coffee aroma.

13. A beverage system according to claim 12 in which the coffee base concentrate has a soluble coffee solids concentration of about 50% to about 65% by weight.

14. A beverage system according to claims 12 or 13, in which the coffee base concentrate includes an alkali.

15. A beverage system according to any of claims 12 to 14, in which the coffee base concentrate subjected to ion exchange treatment to raise pH.

16. A beverage system according to any of claims 12 to 15, in which the coffee base concentrate subjected to membrane fractionation for removal of acid precursors.

17. A beverage system according to any of claims 12 to 16, in which the coffee aroma includes an oxygen scavenger.

18. A beverage system according to any of claims 12 to 17, in which the coffee base concentrate includes an oxygen scavenger.

19. A beverage system according to any of claims 12 to 18, in which the container is a pouch comprising barrier films.

20. A method for improving the storage stability of a coffee concentrate, the method comprising separately storing a coffee base concentrate having a soluble coffee solids concentration of at least 10% by weight and from which coffee aroma has been removed; and coffee aroma.

INTERNATIONAL SEARCH REPORT

Inter ɔnal Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A23F5/24 A23F5/48

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A23F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
WPI Data, PAJ, EPO-Internal, FSTA

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
23 October 2000	31/10/2000

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INTERNATIONAL SEARCH REPORT

Inter nal Application No
PCT/EP 00/04409

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INTERNATIONAL SEARCH REPORT

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